

WHAT IS CLAIMED IS:

1. A flat float glass that can be prestressed or transformed into a glass ceramic with high quartz mixed crystals or keatite mixed crystals, that has a concentration of less than 300 ppb Pt, less than 30 ppb Rh, less than 1.5 wt.% ZnO and less than 1 wt.% SnO<sub>2</sub> to prevent undesirable surface defects during floating, and that is refined during melting without the use of the conventional fining agents arsenic oxide and/or antimony oxide.

2. The flat float glass of Claim 1 comprising a composition in weight percent on an oxide basis of:

Li <sub>2</sub> O	3.2-5.0
Na <sub>2</sub> O	0-1.5
K <sub>2</sub> O	0-1.5
∑ Na <sub>2</sub> O+K <sub>2</sub> O	0.2-2.0
MgO	0.1-2.2
CaO	0-1.5
SrO	0-1.5
BaO	0-2.5
ZnO	0-<1.5
Al <sub>2</sub> O <sub>3</sub>	19-25
SiO <sub>2</sub>	55-69
TiO <sub>2</sub>	1.0-5.0
ZrO <sub>2</sub>	1.0-2.5
SnO <sub>2</sub>	0-<1.0
∑ TiO <sub>2</sub> +ZrO <sub>2</sub> +SnO <sub>2</sub>	2.5-5.0
P <sub>2</sub> O <sub>5</sub>	0-3.0

optionally with the addition of coloring components such as V, Cr, Mn, Fe, Co, Cu, Ni, Se and/or Cl compounds.

3. Flat glass as claimed in Claim 2, characterized by a composition (in wt.% on an oxide basis) of:

Li <sub>2</sub> O	3.5-4.5
Na <sub>2</sub> O	0.2-1.0
K <sub>2</sub> O	0-0.8
∑ Na <sub>2</sub> O+K <sub>2</sub> O	0.4-1.5
MgO	0.3-2.0
CaO	0-1.0
SrO	0-1.0
BaO	0-2.5
ZnO	0-1.0
Al <sub>2</sub> O <sub>3</sub>	19-24

SiO <sub>2</sub>	60-68
TiO <sub>2</sub>	1.0-2.0
ZrO <sub>2</sub>	1.2-2.2
SnO <sub>2</sub>	0-0.6
Σ TiO <sub>2</sub> +ZrO <sub>2</sub> +SnO <sub>2</sub>	3.0-4.5
P <sub>2</sub> O <sub>5</sub>	0-2.0

and optionally with the addition of coloring components such as compounds of V, Cr, Mn, Fe, Co, Cu, Ni, Se and/or Cl.

4. The flat glass as claimed in one of the Claims 1 to 3, characterized by the fact that the sum  $\text{Li}_2\text{O} + \text{Na}_2\text{O} > 3.5 \text{ wt.}\%$  to produce chemically prestressed float glass.

5. Flat glass as claimed in one of the Claims 1 to 4, characterized by the fact that to prevent the formation of an undesirable crystal band near the surface during floating, the following expression (in wt.%) is valid:  $3.2 \times \text{ZnO} + \text{TiO}_2 \leq 4.3$ .

6. Flat glass as claimed in one of the Claims 1 to 5, characterized by concentrations of less than 200 ppm  $\text{Fe}_2\text{O}_3$  and less than 2.5 wt.%  $\text{TiO}_2$  to counteract undesired coloration in the vitrified state and to achieve a light transmittances at a thickness of 4 mm of > 89% and preferably > 90%.

7. Flat glass as claimed in one of the Claims 1 to 6, characterized by the fact that the glass is technically, or industrially, free of ZnO and BaO.

8. Flat glass as claimed in one of the Claims 1 to 7, characterized by a coefficient of thermal expansion  $\alpha_{20/300}$  between  $3.5$  and  $5.0 \times 10^{-6}/K$ , a transformation temperature  $T_g$  between  $600$  and  $750^\circ C$  and a processing temperature  $V_A$  below  $1350^\circ C$ .

9. Flat glass as claimed in one of the Claims 1 to 8, characterized by the fact that the glass ceramic manufactured by transformation has a transparent, translucent or opaque appearance, and has an additional color when coloring components are added.

10. Flat glass as claimed in one of the Claims 1 to 9, characterized by a coefficient of thermal expansion  $\alpha_{20/700}$  of less

11. Flat glass as claimed in one of the Claims 1 to 10, characterized by a coefficient of thermal expansion  $\alpha_{20/700}$  of  $(0 \pm 0.5) \times 10^{-6}/K$ , preferably  $(0 \pm 15) \times 10^{-6}/K$ , after transformation into the glass ceramic with high quartz mixed crystals as the predominant crystal phase of

13. Flat glass as claimed in Claim 11, characterized by the fact that the glass ceramic is colored with V, Cr, Mn, Fe, Co and/or Ni compounds with a light transmittance of  $< 5\%$  at a thickness of 4 mm.

15. Flat glass as claimed in one of the Claims 1 to 14, characterized by the fact that to achieve a low number of bubbles, the glass melt is physically fined, e.g. by underpressure or by means of high temperature  $> 1750^{\circ}\text{C}$ .

said glass being configured at least as one of:

(b) to be capable of being transformed into a glass ceramic  
g surficial high quartz mixed crystals or keatite mixed  
als;

said glass having a minimized concentration of (c), (d), (e), and (f) to minimize surface defects on said glass;

said glass comprising:

(c) less than three hundred parts per billion of platinum (Pt);

(d) less than thirty parts per billion of rhodium (Rh);

(e) less than one point five weight percent zinc oxide (ZnO); and

(f) less than one weight percent of tin dioxide ( $\text{SnO}_2$ ); and

said glass comprising refined glass that is refined during melting in the absence of substantially all of (i.), and (ii.):

(i.) arsenic oxide; and

(ii.) antimony oxide.

17. A flat float glass having surface defects which are minimized;

said glass comprising at least one of:

(a) a prestressable flat float glass;

(b) a glass ceramic being transformable into a glass ceramic comprising high quartz mixed crystals; and

(c) a glass ceramic being transformable into a glass ceramic comprising keatite mixed crystals;

said glass having a minimized concentration of (d), (e), (f), and (g) to minimize surface defects on said glass during floating thereof, said glass comprising:

(d) less than three hundred parts per billion of platinum (Pt);

(e) less than thirty parts per billion of rhodium (Rh);

(f) less than one point five weight percent zinc oxide (ZnO); and

(g) less than one weight percent of tin dioxide ( $\text{SnO}_2$ ); and

said glass comprising refined glass; said refined glass being substantially free of all of (i.), and (ii.):

- (i.) arsenic oxide; and
- (ii.) antimony oxide.

18. A method of making flat float glass having surface defects which are minimized, said method comprising:

(A) melting and refining glass substantially in the absence of

- (i.) arsenic oxide; and  
(ii.) antimony oxide;

(B) floating said glass and minimizing surface defects in said glass during floating of said glass by minimizing the concentration of (a), (b), (c), and (d) to:

- (a) less than three hundred parts per billion of platinum (Pt);
  - (b) less than thirty parts per billion of rhodium (Rh);
  - (c) less than one point five weight percent zinc oxide (ZnO); and
  - (d) less than one weight percent of tin dioxide (SnO<sub>2</sub>);
- and

(C) producing at least one of:

- (C1) producing a prestressable flat float glass;  
(C2) producing a transformable flat float glass being transformable into a glass ceramic comprising high quartz mixed crystals; and

(C3) producing a transformable flat glass being transformable into a glass ceramic comprising keatite mixed crystals.

19. The method according to Claim 18, comprising use of at least one coloring agent, said at least one coloring agent being selected from the group comprising: compounds of vanadium (V), such as vanadium pentoxide ( $V_2O_5$ ), compounds of chromium (Cr), such as chromic oxide ( $Cr_2O_3$ ), compounds of manganese (Mn), such as manganese dioxide ( $MnO_2$ ), compounds of iron (Fe), such as iron

oxide ( $\text{Fe}_2\text{O}_3$ ), compounds of cobalt (Co), such as cobalt oxide ( $\text{CoO}$ ), compounds of copper (Cu), such as copper monoxide ( $\text{CuO}$ ), compounds of nickel (Ni), such as nickel oxide ( $\text{NiO}$ ), and compounds of selenium (Se), and/or compounds of chlorine (Cl).

20. The flat float glass of Claim 1 comprising a composition in weight percent on an oxide basis of:

$\text{Li}_2\text{O}$	3.2-5.0
$\text{Na}_2\text{O}$	0-1.5
$\text{K}_2\text{O}$	0-1.5
$\sum \text{Na}_2\text{O}+\text{K}_2\text{O}$	0.2-2.0
$\text{MgO}$	0.1-2.2
$\text{CaO}$	0-1.5
$\text{SrO}$	0-1.5
$\text{BaO}$	0-2.5
$\text{ZnO}$	0-<1.5
$\text{Al}_2\text{O}_3$	19-25
$\text{SiO}_2$	55-69
$\text{TiO}_2$	1.0-5.0
$\text{ZrO}_2$	1.0-2.5
$\text{SnO}_2$	0-<1.0
$\sum \text{TiO}_2+\text{ZrO}_2+\text{SnO}_2$	2.5-5.0 and
$\text{P}_2\text{O}_5$	0-3.0.

21. The flat float glass according to Claim 20 which comprises coloring components such as compounds of V, Cr, Mn, Fe, Co, Cu, Ni, Se and/or Cl.

22. Flat glass as claimed in Claim 2, characterized by a composition (in wt.% on an oxide basis) of:

$\text{Li}_2\text{O}$	3.5-4.5
$\text{Na}_2\text{O}$	0.2-1.0
$\text{K}_2\text{O}$	0-0.8
$\sum \text{Na}_2\text{O}+\text{K}_2\text{O}$	0.4-1.5
$\text{MgO}$	0.3-2.0
$\text{CaO}$	0-1.0
$\text{SrO}$	0-1.0
$\text{BaO}$	0-2.5
$\text{ZnO}$	0-1.0
$\text{Al}_2\text{O}_3$	19-24
$\text{SiO}_2$	60-68
$\text{TiO}_2$	1.0-2.0
$\text{ZrO}_2$	1.2-2.2
$\text{SnO}_2$	0-0.6
$\sum \text{TiO}_2+\text{ZrO}_2+\text{SnO}_2$	3.0-4.5 and

P<sub>2</sub>O<sub>5</sub>

0-2.0.

23. The flat float glass according to Claim 22 and comprising coloring components such as compounds of V, Cr, Mn, Fe, Co, Cu, Ni, Se and/or Cl.

24. The method according to Claim 18 comprising one of: a transformation temperature T<sub>g</sub> between 600 and 750°C, and a processing temperature V<sub>A</sub> below 1350°C for a glass characterized by a coefficient of thermal expansion  $\alpha_{20/300}$  between 3.5 and 5.0 x 10<sup>-6</sup>/K.

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